Science and Society: towards a democratic science

(seminar 0027)

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Contents

1 Introduction

Who does science work for? Why does new knowledge sometimes fail to improve our everyday lives? Who needs to be involved in the processes that develop – and respond to - new technologies? These were some of the questions discussed at the British Council seminar, 'Towards a democratic science'. The aim was to identify the changes that need to be made to the communities, practices and culture of science, to allow people's needs and wishes to become embodied in scientific paths and technological developments. Using their diverse range of experiences, participants from around the world identified an agenda for a democratic science and more inclusive innovations.

The seminar programme was designed to focus progressively on a possible agenda for a democratic science. To begin with, participants considered the pressures that globalisation and democracy have placed on the way science is conducted, the current state of modern science and how it is portrayed, including the voices of opposition. Following on from this, delegates learned more about the negative impacts created by the current state of science, in particular, the repercussions of BSE and HIV/AIDS. Throughout this process, the key issues and actions identified by participants were drawn out of the discussions and fed into later stages. In this way, they were able to put forward possible policy responses that would help science face the challenges of public accountability in a more democratic world.

2 Changing communities: democracy and globalisation

Perspectives on science and globalisation

Globalisation may have created world-wide opportunities, but it has also created new problems. For example, Naomi Klein has quoted Pierre Pettigrew, Canada's Minister of International Trade as saying, 'In the new economy, the victims are not only exploited, they're excluded. You may be in a situation where you are not needed to create that wealth. This phenomenon of exclusion is far more radical than the phenomenon of exploitation.' [1]

Where science and technology are concerned, this exclusion doesn't just restrict the direction of scientific inquiry and the communities of interest served by practical innovations; it also influences the extent to which new knowledge can be created, discussed and made use of. Efforts to end this exclusion are sorely needed. As Kline argues, 'a society that blithely accepts this included/excluded ledger is an unsafe society. It is filled with people who have little faith in the system, who feel they have nothing to gain from the promises of prosperity.' [2]

Writers such as Klein and Monbiot [3] help to explain why acute concerns are being raised about how science can respond to different public needs and values around the world. In recent times the speed of globalisation has profoundly affected investment, innovation and communication, creating new tensions, public alienation and resistance. Such concerns have traditionally been attributed to public ignorance of science, to be remedied by education. But more recently this perspective (called the 'deficit model' or the 'public understanding of science') has been rejected. [4-9] The view is that blaming the public for dislocations in the science-society relationship 'ignores . . . perfectly rational processes of issue re-definition or re-framing in particular contexts; and . . . inspires a great deal of unproductive or even counter-productive one-way communication between science and a sceptical public.' [8] It also fails to involve the communities who are commonly excluded from the innovation process, so the resulting technologies do not meet these different needs [10]. Academics and practitioners now advocate a more fundamental change to the culture of science, so that it has a better understanding of its publics.

Science and democracy

Lloyd Anderson, Director of Science at the British Council, asked participants to consider two key questions. The first was, 'Who is the public?'. The second was, 'What is the purpose of having a dialogue between science and society?' A recent study [11] had suggested there were two main reasons to create and support a dialogue between science and the public: to support democracy and to make better decisions.

David Steven, Managing Director of River Path Associates, spoke of the need to open up the whole process of science. Globalisation, he said, was influencing three spheres of human experience: liberalisation, economic development and human development. Science has a critical role in the delivery of wealth creation and quality of life issues. 'The question is,' he said, 'Can the way science is organised satisfy people in the long-term?'

Charles Leadbeater, author of *Living on Thin Air* [12] and *The Weightless Society* [13], gave a presentation about democracy and the knowledge economy, arguing that it is how knowledge is put to use that is important. 'We need to understand that science is involved in a political battle for its future,' he said. 'Science has to engage with how it is governed and for whom it is accountable in a way it has never done before'. Leadbeater argued that on the one hand, democracy was good for science, because radical knowledge creation thrives in a society where authority can be challenged. On the other hand, said Leadbeater, science was also good for democracy, as science is posing issues for global governance, in environmental issues, for example. 'The question is,' he said, 'Do we want better governance, or better self-governance?'

The author suggested that innovation can have negative as well as positive effects: 'People are inventing technologies thinking they know how people want to use them,' he said, 'and people are inventing trivial technologies.' He also said that it is no longer necessary for people to understand the technologies they use - understanding does not improve efficient use.

Leadbeater said that science creates new knowledge: it also creates ignorance. The key issue was how to manage this ignorance in a world where society is becoming further disconnected from scientists. 'People are questioning the

value of change and innovation and all that it brings,' he said. But if we are willing to accept that innovation can have both positive and negative effects on different communities, then an increasing tendency to question innovation could be seen as a positive social development.

So, is democracy good for science, and *vice versa*? Participants discussed this question and concluded that science can be both good and bad for democracy, and democracy can be both good and bad for science. They believed that efforts to help the will of the people to become embodied in technological developments will depend on the scientific work that is being carried out, the types of democracies that exist, and the kinds of political processes and interactions that are found in different local contexts today.

Participants suggested that:

1. The emphasis needs to be on understanding how scientific/democratic processes can be adapted in different local contexts to encourage the use of technologies nationally
2. Trans-national systems and mechanisms which currently try to do this have different effects in different countries (e.g. the European Commission's Research, Technology and Development Framework Programme)
3. Public involvement is made more difficult because scientists don't want - or feel unable - to communicate their work, even though they are funded by the public and are accountable to it
4. Scientists worry about how public science communication will affect their standing and careers. Younger researchers are more likely to get involved
5. Public involvement in science is made more difficult because students can drop science altogether from their studies, and scientists can progress through the education system without understanding the media or how to communicate with non-scientists
6. Yet science cannot become more democratic until scientists have both the skills and inclination to communicate with non-scientific communities. Changes are needed to encourage the latter also
7. Changing the education system is therefore just one way to encourage a more democratic science
8. Long research projects need to produce communications before the end of the research. Dolly the sheep, for example, came as a big shock to everyone
9. The pressure to innovate through industry is preventing access to scientific results and data. It is also eroding *trust*: the key element of the democratic process

Science, globalisation and a new understanding of expertise

Brian Wynne, Research Director of the Centre for the Study of Environmental Change at Lancaster University, and Manjit Kumar, Editor of the journal *Prometheus*, discussed science and globalisation.

Wynne drew the participants' attention to science communication research [4-9, 14-18] which has found that, contrary to the public understanding of science (PUS) viewpoint, more informed people are *less* accepting of science, technology, and the advice of scientific institutions. European data show that people in Finland, the Netherlands and the UK are more knowledgeable and less accepting about science than people in Greece and Portugal, for example.

Wynne also spoke of the work of Ulrich Beck [19], who believes that the modern risks created by science are global in scale, sensible only to the scientific community, and are incalculable in scale or probability. As a result, people are looking for reliable information, from non-governmental organisations and other civil society groups. They consider that institutions have created these risks but can no longer protect them. This is a problem as the risks are uninsurable, pervasive geographically and socially, and indifferent to social class. They are also irreversible.

Wynne also called to question the kinds of expertise that are needed in the 'knowledge economy', stressing the importance of expertise which is not seen as scientific. He called this 'lay knowledgeability'. He said that if science has become globalised, it has also become 'less in touch' with local contexts. 'And yet', he explained, 'we have to create an understanding of those local contexts in order to do effective science.'

The link between democratic science and innovation is therefore local context. Wynne said, 'Very often people are saying, "It's not that I don't believe you, but what you say isn't true in my particular circumstance . . ." People are not anti-science. They are pro- better science.' Kumar agreed. 'There isn't a blanket rejection of science as a whole,' he said, 'It's a pick and mix.'

Wynne spoke of the need for a clearer focus on the kinds of scientific work that are being carried out. 'We have to ask ourselves, under what conditions and for what purpose is this work being done? Let's make sure that these things are there for the right reasons and for the right purpose,' he said. The first three speakers all spoke of a need for change in the relationship between

science and society, under the pressures of globalisation and the changing democratic processes. But what kinds of change could realistically be expected? Participants discussed four scenarios, reflecting different global societal and economic trends, macro economic prospects and energy policy agendas that might influence the relationship between science and society in the future. These were:

1. *'Conventional Wisdom'.* Business as usual. Decisions involving science, innovation and society carry on being made as they are at the moment.
2. *'Battlefield'.* Different countries withdraw from international co-operation, adopting protectionist policies and strategies. An uneasy world of isolationism and power blocks.
3. *'Hypermarket'.* Dominant market forces, alliances, liberal free trade and a minimum of government intervention.
4. *'Forum'.* Open and inclusive international communications guide decisions involving science, innovation and society. Strong public administration and intervention; the world moves more to consensus and co-operative international structures.

At the moment, many developed countries are somewhere in-between the 'hypermarket' and 'forum' scenario. Participants from these countries had been subjected to the ideology of the free market economy since the late 1980s, and now wanted to see more public control (i.e. a move from ‘hypermarket’ to ‘forum’). Participants from less developed countries, conversely, looked to the ‘hypermarket’ model as a panacea for their ills, and so were moving from relative isolation (i.e. ‘battlefield’) towards a more global, free market economy. After much discussion, the participants concluded that the influence of different scenarios on science-related development would be more pronounced in certain countries. For example, the effects of the ‘hypermarket' scenario would be particularly marked in a small nation state. Cultural differences (e.g. attitudes to education, the value of science skills in the workplace) would influence the extent to which we can move between these scenarios.

Especially in science, people move between countries and communicate with distant neighbours, so creating new communities of interest. But the participants suggested that we may be deluding ourselves in the way we discuss globalisation. Distance and local context matter. In general,

participants thought the effects of the hypermarket model are unsustainable, both for science, the world and its natural resources.

Participants spoke of their hope for the 'forum' scenario, and some saw the seeds of change that will make it happen. However, given the strong influence of 'hypermarket' forces today, they asked if it was realistic to hope for this. They saw the hypermarket situation as leading to one way of doing things; science for one purpose (profit) to the exclusion of all other purposes. It also leads to private organisations telling people how to live their lives (through brands etc.). In addition, by reducing public involvement in science and innovation to the decision whether or not to buy, it conceives individuals not as adaptive, diverse citizens, but as passive, homogeneous consumers.

So, what steps could be taken to move from the hypermarket to the forum model, especially considering that the gap between the rich and poor is widening, and that only around five per cent of the developing world is 'connected' to the emerging 'forum' networks? Participants said they wanted internationalised science. But this was not the same as globalisation, which was seen to be autocratic, not democratic. Most worryingly, participants thought that if we do not climb out of the hypermarket and create a forum, we will destroy the international nature of science by inevitably tripping into a ‘battlefield’ scenario. They concluded we need to find ways (perhaps using small forums, or a hyper-forum) to adapt the systems that exist locally and move towards a forum model for a better world.

3 Changing practices: science in transition

A new way of doing science

'Definitions constrain thinking,' said Michael Gibbons, Secretary General of the Association of Commonwealth Universities. 'Take a look at what people are doing around you. A new style of doing science is emerging, and in every dimension, it is different.' Gibbons calls this emerging 'mode' of doing science 'Mode 2 knowledge production'. In his book, 'The New Production of Knowledge', Gibbons compares Mode 1 and Mode 2 research thus:

'For many, Mode 1 research is identical with what is meant by science . . . its problems are set and solved . . . by the largely academic community. In contrast, Mode 2 research is transdisciplinary . . . carried out in a context of application and includes a wider . . . set of practitioners, collaborating on a problem defined in a specific and localised context.' [20]

'When I speak of the context of application,' said Gibbons, 'I am not talking about applied science. The knowledge can't be "applied" because there is no knowledge [yet] to apply.' In this new way of working, 'facts' and 'values' are no longer distinct entities, as they both contribute to the solution of problems. 'As these values come to light, so the practitioners begin to formulate the problem differently, they begin to think that different things are worthwhile doing,' he said.

The end of the distinction between science and society

Gibbons argued that the very idea of talking about 'facts' and 'values' does not fit with the practice of doing research today, where many different communities are involved in the identification, formulation and solution of problems. 'To talk about science and society,' he said, 'is to imagine that there are distinctions that are valid'. Like the researcher Thomas Hughes [21], Gibbons believes that listening to what social groups have to say leads to a better technical solution. 'If I am right,' he said, 'then we have a major social transformation going on. People are stacking careers. If the system doesn't allow us to do it, we find a way to do it. Professors are tunnelling out, and they don't always tell the Vice-Chancellor.'

Mode 2 science in practice

Participants were asked to consider whether Mode 2 activities were happening, or possible in their own countries. In general, delegates recognised the pressures that encourage Mode 1 and discourage Mode 2 activities in their countries. In some places institutional resistance is greatest in universities, and in others it is greatest in isolated research institutes. They said that it was sometimes easier for transdisciplinary work to take place in international networks than in national or regional ones. In some countries, even Mode 1 research was not well established. Participants suggested that supporting Mode 2 activities might require us to short-circuit the government altogether.

Moving away from considerations of the current institutional system and towards actual practice, participants from many countries identified with the 'tunnelling out' behaviour that Gibbons spoke of, as scientists push against the system to become involved with knowledge production in the context of its application. Boundaries are being blurred, but with difficulty. Participants from some countries spoke of teaching as taking place within a Mode 1 framework, feeding skills back into Mode 2 activities and emerging Mode 2 systems. Mode 2 activities were seen to be associated with projects and personal activities.

Participants suggested that the production of more socially robust knowledge (Mode 2 research) was easier in smaller countries than in larger ones. They also felt that the hope for change rests with the young (pointing to the need for changes in education systems) and with non-government, non-academic organisations (such as patient support groups) involving people who have what Brian Wynne called 'lay knowledgeability' and the strength of will to make it happen.

Delegates suggested that if we are to encourage Mode 2 work in science, we will have to reconsider the nature of expertise, and develop new ways of thinking about management, power and responsibility (because, for instance, if everyone is equal, who is in control? Where does the buck stop?). They also said that this dialogue requires people to find ways of communicating across cultural barriers of all kinds.

The strengths and weaknesses of the new way of doing science

After discussing whether or not Mode 2 activities existed, or were likely to exist in their different countries, participants considered the strengths, weaknesses, opportunities and threats of a world characterised by Mode 2 science.

Strengths

Mode 2 science was seen to:

- address the needs of society
- find local, specialised, personalised solutions
- encourage diversity
- communicate complex research in advance of the 'results'
- be more democratic - the research and the communication are part of the same process
- be permeable
- fit with lifelong learning
- provide efficient results, effective for the particular community served
- break down hierarchies
- make it possible to share resources

Weaknesses

Mode 2 science was seen to:

- require the crossing of institutional, socio-economic, cultural and language barriers
- involve a difficult transition, which we aren't used to
- require a quality system that does not yet exist
- need new tools and methods for management, training and communication
- provide no source of independent advice
- reward the fastest research
- create difficulties associated with coping with the demands of Mode 2 flexibility and the conflicting time/effort/loyalty demands of everyday life

Opportunities

Mode 2 science was seen to:

- create new types of wealth
- provide new marketing tools
- yield opportunities associated with flexibility
- provide a means to improve dialogues about science as the research and the communications are part of the same process
- encourage researchers to take more responsibility for the public
- involve user-interaction that encourages innovation
- be a way of handling fear
- offer new opportunities for sharing resources, networking, mobility and knowledge-economy activities

Threats

A world characterised by Mode 2 science was seen to:

- pose a threat to research diversity. Without Mode 2 institutional systems, scientists are 'tunnelling out' of Mode 1 only to a certain type of Mode 2 work - where the purpose is the pursuit of profit
- create problems of responsibility: if all are equal, who is responsible?
- create inequality if only certain communities are involved
- deliver products, but not for the right purposes, under 'hypermarket' forces
- create competition between Mode 1 and Mode 2, which might make Mode 2 prevail, when we need both, particularly for training
- discourage work that improves social well-being (under current Mode 1 institutional systems)

When asked to consider how these ideas could be turned into practice, participants suggested that there would be no one solution to finding and creating a new relationship that would satisfy everybody. The challenge will be to help people use new knowledge and data in a way that fits with local conditions and traditions.

Participants said that a democratic science requires scientists with the freedom to explore different fields of inquiry in a framework that is transparent and accountable. But finding ways of doing this will not be easy. In general, it was felt that there would be no 'one size fits all' mechanism to make the relationship between science and the many communities around the world more democratic. The practice of democratising science will be different in different local contexts. So how can global issues be addressed? Might it be useful to consider the role of contesting forces, such as the media and other communities within society, in influencing the evolution of a democratic science and the development of inclusive technologies?

4 Changing cultures: mediated science and public voices

Mediated science

The media is a strong influence on the dialogues between science and society. Tim Radford, Science Editor of *The Guardian*, spoke of the media as 'the filter through which debate happens. We influence, but we also reflect.' Radford said that those in power have a tendency to forget that democracy is not about persuading people to take their point of view. 'And there is no corresponding responsibility to listen.'

Unlike those who argue for a better 'public understanding of science', Radford argued that improving the relationship between science and society could not simply be about education. 'Better educated people just ask tougher questions.' One problem, said Radford, is that 'the scientist addresses people in the language he [or she] habitually uses.' To attract attention, scientists have to learn the language of the street.

Radford spoke of the 'fallacy' that academic language encourages clarity, highlighting one example: the long, conflicting, impenetrable definitions of the precautionary principle that exist today. 'If you turn these into English, it becomes "look before you leap,"' he said. But getting the message across isn't simply a matter of clarity. 'We don't just want discussion,' he explained, 'we want impassioned discussion'.

The different motivations of politicians and scientists

Sir Robert May, President of the Royal Society, discussed the democratisation of science as involving different kinds of 'interactions between science and government, between science and the public, and between government and the public. He said that it was important to remember that many governments fund science not for cultural reasons, not even because they need science, but because science is seen as the bedrock of economic performance. 'This,' he pointed out, 'is a quite different motivation than those who actually do science.'

The need for democratic decision-making processes

In Sir Robert's view, the challenge was to find ways to encourage a dialogue so that the problems are recognised, enabling people to respond to events and to make their own choices. 'People in more comfortable countries need to think about the effects and opportunities that new knowledge gives us' he said. As an example of a fruitful dialogue about science, Sir Robert discussed the UK's response to the development of new fertility treatments, which raised problems and issues that were resolved 20 years ago. Sir Robert praised the inclusive process that helped make these decisions in the UK. 'It runs the risk that we would have got the wrong answers. But I believe the process is right.'

Sir Robert said that democratic science was not simply about safety issues. It is a debate about the kind of world we want. 'More and more,' said Sir Robert, 'I wish for a global mechanism to make these decisions. We're going to learn more at an ever-faster rate. The problems that will be presented to us in the future will make the issues of today look like a shadow on a wall.'

Science and civil society

Like the public, civil society groups are not anti-science *per se.* 'I know of only two groups that oppose scientific developments across the board,' said Doug Parr, Chief Scientific Officer of Greenpeace UK. For Greenpeace, being selective about technological developments means they are scrutinised with respect to:

- our ability to control and manage changes
- reversibility
- equity
- the intrinsic characteristics of the technologies concerned (are they self-replicating?)
- the distribution of the positive and negative effects of their implementation and use. 'Often we find that the negative effects are experienced locally, and the benefits are going elsewhere.'

Scientists are sometimes portrayed as 'evil manipulators', but Parr did not subscribe to this view. 'Scientists are players in society just like everybody else,' he said. 'But collectively, science has its share of responsibility,' he added. 'There are things outside conventional scientific analysis which protest groups want to see introduced into the frame.'

Greenpeace doesn't just have an interest in voicing concerns about the science that is being done: it is also concerned about the kind of research that is not being done. For example, it believes that the lack of investment in renewable energy research in the UK 'is an absolute scandal'. Parr discussed a few examples of the work that is currently being supported, financially and otherwise, by Greenpeace UK (e.g. research into renewable energy, biological control in agriculture, market-assisted breeding, and bio-compostable plastics). 'We are a very pragmatic organisation,' he said. 'We have to think: what is our ability to influence this, to achieve something?'

Greenpeace is particularly interested in developments it perceives as creating undesirable technological trajectories: paths in technological development which move science and technology in directions that are difficult to manage, irreversible, inequitable, self-replicating, or that are associated with an unequal distribution of negative impacts or benefits. Parr discussed nuclear power, genetically modified crops, and the dumping of oil installations in relation to this. 'Brent Spar was a commitment to re-open ocean dumping as a means of waste disposal,' he said. 'It was taking us on a political trajectory where we didn't want to go.'

According to Parr, pressure groups such as Greenpeace have little power by themselves. He said that they only succeed by gaining the support of the public, influential constituencies and businesses. 'The problem is that one set of interests and values comes along with the official view, and that is called "sound science".'

Parr said that the democratisation of science has to involve what he called *transactional spaces*, 'places that have legitimacy - where all the cards are on the table.' He said, with regards to the debate on genetically modified organisms, that the question "Is this a technology that we want to deploy?" wasn't even on the table. 'A transactional space that requires all perspectives to be put on the table is an absolute prerequisite.' [22]

New perspectives on science communication dialogues

John Tulloch, Head of the School of Journalism, Media and Cultural Studies at Cardiff University, suggested that what was lacking was a deeper focus on the nature of communication systems. 'PUS [the *public understanding of science*

approach] is unfashionable and rightly so,' he said. Tulloch spoke of the need to recognise that 'the public' is not a homogeneous mass, but is composed of many publics. He also highlighted the severe limitations of communication models that perceive knowledge or information as 'flowing' between groups, as an engineer might illustrate current flow in a circuit. He said that terms such as 'efficient communication', 'noise', 'senders' and 'receivers' do much to obstruct our understanding of how people interact with science in their everyday lives. People create meanings not simply from messages in the media, but also from their own experiences, and the transactional spaces that exist to mediate dialogue. He used the example of soap-opera storyline forms, as virtual spaces and timeframes for dialogue about particular issues. 'I think we need to find a Mode 2 model of communication flow,' he said. 'Communication shouldn't be seen as a linear process.'

The role of the media

The *public understanding of science* (PUS) perspective considers the media as a means of 'educating' the public. However, from a democratic science point of view, the media has not one, but a variety of roles to play in dialogues about science. Participants saw the media as channelling answers to the public; representing public interest; helping people to become and remain accountable; identifying the issues that affect different communities; and being the voice of the public (in private) to scientists. The media acts as a filter, place, or transactional space where creative conflict happens.

Participants who worked in the media spoke of the need to change the public's - and scientists' - perception of the media. The media wishes to be seen as a partner in the process of creating a better, wider dialogue about science. Media communities are interested in what their publics are interested in, as a heterogeneous group. The media acts as a mirror to society, playing different roles in different situations and contexts. Delegates working in the media hoped that scientists would learn to communicate with the public. They wanted scientists to create outputs that were quick and easy to digest: information that could help journalists judge whether a piece of new work is, or is not, important.

The media professionals at the seminar spoke of the relationship between scientists and journalists as social, informal and not characterised by linear communication. They said that science in the media is sometimes 'ghettoised' (only attracting the attention of those who are already interested in it) and that it is occasionally manipulated by those with economic or political interests. They stressed that they operated as investigative journalists, rather than spin-doctors for the scientists or the voice of the protestor.

The language of anti-science

Shubha Tole, a scientist from the Tata Institute of Fundamental Research in Mumbai, India, spoke of the way that language can be used to discredit science, taking issue with some of the 'inflammatory terms' used by Doug Parr of Greenpeace. She suggested that it was inappropriate for Parr, as a scientist, to speak of a particular genetic transfer technique as an example of 'rogue science'. Tole said: 'Words like half-pig and half-human are . . . emotionally charged. It seems to me that in this particular case they were simply trying to find an alternative environment in which to grow a human cell nucleus.' Tole noted that one strategy used by opponents of specific scientific work was to avoid talking about its possible benefits ('No information was given about what it is meant for'). Another was to describe work in ways that suggest an alternative set of goals or aims ('half-pig, half human'). Participants discussed the different readings of the term, 'rogue scientist'. On the one hand, it can mean a scientist who does bad science. On the other hand, the term can be used to describe someone who does good science, but outside the moral framework of a particular society or establishment. In other words, science can be 'rogue science' if it goes against scientific or other cultures.

5 Impacts of 20th century science systems

The politics of panic

Lloyd Anderson noted that previous discussions had pointed to the need for 'a new distribution of power between the communities of interest' and that every group of participants had identified the need for a transactional space for interaction. The issue was, he said, 'How do we create these?'. David Steven of River Path Associates suggested that ideas might be found by looking back at what was done in the past, to see how things might have been done differently.

'When BSE was brought to the public's attention in the British Medical Journal, the Government agency was still denying it,' said Stephen Dealler, Consultant Medical Microbiologist, Burnley General Hospital and Director of the BSE Research Group. 'I couldn't understand why . . when it was so obviously true.' Very early on, the scientific argument with BSE had been that the disease came from sheep, and that scrapie was not a danger to people. But the transfer to cows changed the nature of the disease, so that it could infect a whole different set of species, including humans. 'With BSE, there was so much we didn't know,' he said. 'The British Government wasn't lying when it said there was no risk. It really believed that.'

Dealler decided he had to communicate the issues involved to the public. He did this by publishing an article and sending 900 copies to politicians, the media and international contacts on the same day. He also contacted television journalists in time to allow a programme to be broadcast, and supplied the media with contact information to help them to research their stories.

The Food Standards Agency: one democratic science mechanism

The BSE crisis illustrated the systemic failure that Leadbeater referred to in his presentation (see section 2). Decisions were made focusing on one main concern - that the public should not panic unnecessarily. Richard Ayre, Board Member of the Food Standards Agency (FSA), said that his interest was in what could be done in the future.

The FSA was set up on 1 April 2000. It is the only Government Department in the UK that has a statutory commitment to openness. 'We're an odd Department, which is headed by a board of 12 members, not a politician,' explained Ayre. 'Our job is to put the consumer first, not to put jobs or industry ahead of the consumer.' A quarter of the board are scientists, the rest are lay people and journalists. Ayre explained that the FSA can publish any of its advice given to ministers. 'This makes it very difficult for ministers to ignore it,' he said. 'Anybody can turn up at our public meetings.' The Food Standards Agency looks at food issues 'from farm to fork'. It aims to 'make sure that food is safe, and to offer independent, balanced advice'. A 'whistle-blowing' procedure has now been introduced to enable staff to express concerns without fear of victimisation. [23]

Ayre discussed the report of the BSE Inquiry (also known as *The Phillips Report*) [24], which found that 'throughout the BSE story, the approach to the communication of risk was shaped by a fear of provoking an irrational public scare'. The report notes one member of the Ministry of Agriculture, Fisheries and Food's (MAFF) Food Safety Group, as saying:

'One was aware of slightly leaning into the wind. You could not just stand upright and give a totally impartial, objective view . . . There was a stronger danger of being misinterpreted one way rather than another, and we tended to make more reassuring sounding statements than might ideally have been said.' [24]

Ayre and Dealler agreed that modern food production and distribution processes have made outbreaks of disease more likely in the future. Ayre added that current conditions make the 'consequences of the control not working much more widespread'. Dealler drew attention to the need for independent research to ensure and contribute to social well-being. 'Every time I asked for funds to study methods of treatment, they would never give me any money, as this would be an admission that there was a problem,' he said. The lack of independence in other parts of the research process was also an issue. 'You couldn't get things published because MAFF researchers were reviewers in the journals,' he added.

AIDS and the need for everyday language

Turning to the issue of AIDS, David Steven, Managing Director of River Path Associates, said that it was 'a perfect example of the importance of knowledge

and science, and what can go wrong.' He discussed the UK Government's AIDS campaign of the mid 1980s ('Don't die of ignorance'), and the example of a British TV advertisement, which spoke of the new disease thus:

'There is now a danger that has become a threat to us all. It is a deadly disease and there is no known cure. The virus can be passed during sexual intercourse with an infected person. Anyone can get it, man or woman... If you ignore AIDS it could be the death of you. So, don't die of ignorance.'

Steven spoke of one senior civil servant's objection to the campaign approach. 'I objected because the reason why everybody was in ignorance was because we couldn't get ourselves sorted out. When the agency first presented that to me I said, "Oh God, we can't do that – the ignorance is *their* fault?"'

At the time, politicians' general reluctance to use clear, everyday and accurate language to discuss sexual issues and practices did little to address the lack of knowledge about HIV and AIDS. And yet the picture Steven painted was a complex one - of politicians who were once ignorant of human sexuality, but who went on to champion the cause, helping to create continued interest and the involvement of government officials at the highest level. 'Norman Fowler [a Government Minister at the time] took it upon himself to make a difference,' Steven said.

AIDS research has shown that in many parts of the world the structures, traditions and roles that exist in human societies do not fit with the 'tasks at hand' - the changes in sexual practices needed to reduce the risk of HIV infection. This is true in both developing and developed countries, but some countries have been more successful than others in making strides in 'social mobilisation'.

AIDS and Mode 2 research

Steven said that the issues associated with HIV and AIDS have been made harder to address by a total failure to define the problem as needing a Mode 2 approach. 'Five to six years ago,' he said, 'hardly any money had been spent on research for the development of a vaccine.' The situation illustrated that technology is not necessarily a good thing: we often have the wrong technology at the wrong price and in the wrong places.

At the end of 1999, 34.3 million people around the world were living with HIV/AIDS. There were 2.8 million deaths in 1999 and a total of 18.8 million deaths to date. To deal with this problem, Steven identified a number of policy options: social mobilisation; global mobilisation for civic health; Mode 2 research; and the creation of transactional spaces and incentives involving all actors.

'On the face of it', he said, 'the UN's children's vaccine initiative should have been an ideal Mode 2 solution to the problem of children with AIDS'. It was conceived, in a rather linear fashion, as a mechanism for "overseeing the vaccine process, from conception . . . at the laboratory bench to its development by industry and its incorporation into vaccine programmes". The problem was clearly stated: what was needed was a multi-antigen vaccine which gave life-long immunity from a single dose and which was safe, inexpensive, easy to administer to children, stable at tropical temperatures and effective at any time from birth. But, said Steven, inter- and intra-organisational conflict, lack of funding and a lack of international co-operation proved to be insurmountable obstacles for the initiative. Participants spoke of AIDS-related activities and initiatives underway in their own countries. In Thailand, numbers of cases were said to be stable, and, knowing how the disease is spread, people are being more careful. The high STD rates in New Zealand were a cause for concern about people becoming complacent.

Developing an overview of democratic science issues

The British Council's Director of Science, Lloyd Anderson, suggested that participants could use their experience to make suggestions that would move the debate from the abstract to the concrete, through consideration of the Driving Forces, Pressures, States, Impacts and Responses appropriate to the democratisation of science. Participants split into small groups to discuss, particularly in relation to their own countries:

1. the main pressures affecting science and society,
2. the current state of affairs, and
3. possible responses which could constitute a democratic science agenda.

The main pressures

The participants said that some of the pressures influencing the science-society relationship are common to all countries. For example, energy problems are a driving force everywhere, and all countries are currently having problems deciding how to regulate for or against scientific and technological impacts that know no boundaries.

The absence of one pressure - the Cold War - was identified as a factor that has allowed citizens with the affluence and the time to consider moral and social well-being questions to do so. Those communities still living in 'survival mode' are less 'obsessed' with these issues, although they are certainly feeling the effects (for example, from global impacts such as climate change, transport, pollution, nuclear developments). These local communities may be too busy trying to survive to worry about the negative aspects of technological change, but they still need an informed choice in the developments that are influencing their everyday lives.

In developed countries, one pressure on science is created by systems of funding that, in the main, reward only wealth-creating activities. There is a lack of pressure on scientists to do work for its own sake, or for purposes that create social well-being. Scientists want to work for the future of the planet, but in the West, science systems do not involve consideration of human needs and respect for life. There is something wrong in the way that ideology is translated into scientific work.

Current states

On a global level, these pressures have created a state of inequity in knowledge, wealth and technological solutions. Pressure groups like Greenpeace work in certain cases to achieve defined purposes. However, they are pragmatic and work only in selected localities and with specific issues. Today's science and technology touches people's lives directly. People know that 'hypermarket' forces and high rates of change and uncertainty extend and constrain the influence of technologies on everyday lives. They know that new work has the potential for more severe, frequent, irreversible, intended and unintended consequences. They see damage all around them. This has led to insecurity, confusion and distrust - in some countries, throughout the whole

system. Some public, government and business communities are now pushing for a dialogue, each group wishing to further their own interests and satisfy their more demanding and conflicting needs. Scientists fear persecution, instability, anti-science and punishment by unfriendly reward systems. The media is more exploitative than it was, but the public is wiser to them. Governments are reluctantly opening some doors, but not others. People are looking for individuals and groups that mediate interactions between science and society.

Possible responses

Bringing together communities of interest requires skills and resources. It requires a new approach to 'power sharing'; a change from a representational democracy to a participative democracy. This calls for new places, transactional spaces, timeframes (such as a national science week) and channels for interaction between and within communities of interest, to stimulate a discussion of scientific decisions, rather than explanations of them.

It may be that the most effective transactional spaces, timeframes and channels for interaction will be different in systems with different histories, cultures and traditions, with some common ground on global issues. Scientists need to be more proactive, perhaps interacting with civil society groups in some countries and with government in others. In this way, a democratic science requires a dialogue between public, science, media, government and industrial communities adapted to local contexts. Participants in the workshop, and the parallel electronic discussions, noted that we have to think globally but act locally. But the question remains: what guiding principles would help to create this kind of response? As Gary Kass, adviser to the Parliamentary Office of Science and Technology in the UK, wrote in the parallel e-discussion: 'The Science and Society debate can be seen as the move from the diagnosis of a malaise, through an identification of a cause, to the prescription of a cure. The patient appears to be willing to take the medicine, but we still don't really know its formula!'

6 Moving towards a democratic science

Participants worked to define a possible agenda for democratic science, drawing together the findings of the week's presentations and discussions. They considered the global, national and local pressures influencing the current relationships between science and society in different development contexts around the world. The aim was to identify the types of policy changes and mechanisms that could create and support transactional spaces between governments, the media, civil society groups, scientists, business, and the many publics needed for a more democratic science.

Stage 1: the objectives of a democratic science

Participants considered the kinds of delivery tools that could be used to encourage a better dialogue between these communities of interest. They decided that all of the myriad of relationships between governments, the media, civil society groups, scientists, businesses and the many publics were important. They also drew attention to the difference between seeing citizens as active, participatory users and adapters of technology, and as simple consumers. Participants noted that the kinds of relationships that are well established in some countries are not so in others, and that the nature of these relationships changes with the issue, stage and objectives of the dialogue. Places and timeframes where these dialogues happen - transactional spaces - were seen as places of conflict, where people articulate common ground. Importantly, they said that such spaces do not exist until people see the need and opportunity to interact. Participants identified a number of objectives, which form a democratic science agenda. Efforts to promote a democratic science need to encourage:

- openness
- transparency
- responsibility and accountability
- independent advice and research
- appropriate technological trajectories (both globally and locally)
- meaningful dialogues
- skills and education policy development
- equality in the distribution of knowledge and technological solutions
- initiatives to forecast, recognise and resolve conflict

Stage 2: Today's science and how it needs to change

Participants considered the pressures that could influence efforts to make science more democratic, such as media campaigns, civil society protests, trade barriers, export/import patterns, and systems to support whistle-blowers (perhaps career protection and research funds). They identified the lack of many of the systems that are needed for a democratic science: a lack of preventative, as opposed to reactive, systems; a lack of fast-working, independent, transparent, open political systems; a lack of flexible, appropriate education systems; and a lack of systems to provide information about commercial products (e.g. GM labelling). In particular, they saw a need for political systems and institutions that reward whistle-blowers and researchers who do socially-beneficial research. Current systems do not learn from failure and this is especially important. An adequate public funding of independent research and risk analysis is also missing. There is a lack of knowledge and tools to evaluate problems. Systems need to be in place so that there are independent experts to represent all communities of interest.

Characteristics of an agenda for a democratic science

In response to these pressures, participants felt that governments should become less short-termist in outlook. They could create organisations like the Food Standards Agency, which gives advice to government and the public at the same time. Such organisations should have no one person at the top. Mechanisms to create dialogues between science, government, the media, industry and the many publics need to fit within existing public regulations and local contexts. Participants said that governments need to encourage independent work, reflection and re-evaluation, and they need to stop focusing on the avoidance of panic. The participants said that scientists need to accept - and be encouraged to accept - that they have a responsibility to the public. The public needs to get involved with self-help groups and civil society. In general, the participants said, responses need to be developed from a framework which looks at each community of interest (government, public, civil society, media, business, science) and the kinds of changes, transactional spaces and mechanisms required to create a dialogue between them in different local contexts.

How the different communities of interest need to respond

Wrapping up the feedback from the week's discussions, David Steven of River Path Associates summarised the main pressures affecting the state of the current science-society relationship, as described in section 5. He noted that participants had described the current state as one of *transition and confusion*, and that they had identified the need for scientists, government, the media, business, civil society and the many publics to change in favour of more *openness, accountability and responsibility*.

Scientists

The current situation is making scientists feel they are under attack and misrepresented, leaving them with a lack of confidence in dealing with the exciting opportunities that exist in a time of tremendous change. To improve their situation, Steven said that a cultural change in science was required. Scientists need to get involved in new forms of training and education; in Mode 2 ways of working; in diversifying the community of science (for example, by recruiting and retaining more women in science); and by being willing and able to engage with their many publics.

Government

Steven said that today's government systems were inappropriately structured to deal with the problems and issues rising from a democratic science. Those in government were struggling to deal with competing pressures and obligations, and such pressures are making it very difficult for the needs and wishes of the people to become embodied in the routes that science and technology developments take. Governments need to respond by creating mechanisms that can respond quickly; looking at the long-term; budgeting for a democratic science; identifying and articulating these problems; valuing the input of science to the policy-making process (not just the policy-validating process); supporting education and research funding in ways which support democratic science objectives; becoming more representative (for example, more women in Government); being more honest and, above all, becoming more transparent.

The media

Steven said that the week's discussions had shown the media to be a diverse group with differing objectives. The media operate in an intensely competitive environment, without the full engagement of scientists. As a result, media professionals suffer from data overload and struggle to keep up with developments in science. Yet the media is very potent and has the power to influence many different communities. Steven suggested that responses were needed to help the media have an 'intelligent interaction with science'. Media organisations need professionals on the newsdesk who are scientifically aware, science desks, media fellowships, and responsible dialogue.

Business

Industry is setting the agenda for science. Other communities are now aware of this and question whether or not this is a good thing. Yet industry is not a homogeneous group. Some businesses see the need for science, others are 'on the fence'. Some feel threatened by the reaction of consumers/citizens, others are doing their best to exploit it. Businesses can be encouraged to innovate, taking into account the needs and effects of their technological developments on different communities, but there is a need to find ways to do this, given that industry always acts for commercial gain.

The many publics

Some people are operating in survival mode; they are more concerned about improving their difficult lives than they are about technological developments, even if they are experiencing positive or negative effects of local or global technologies. More affluent communities are very worried and don't know where to turn. They are uncertain about what they eat, and the technologies they use (e.g. communications and transport technologies). The more informed are more, not less, concerned. There is distrust and disempowerment. People recognise that scientific decisions are being made in response to issues without regard for the science involved. The many publics can help to democratise science by pushing for more openness, more accountability and more responsibility in government, science, industry and civil society. They can use their power as consumers and engage in democratic processes.

Civil society

A huge growth in civil society groups has taken place, and they are very active over some issues in some contexts. These groups use the system, the media and technologies to set the agenda, and to influence decision-making processes, events and developments across national boundaries. But they need to be more creative and more willing to engage in dialogue about scientific issues. Even more importantly, said Steven, science should see itself as part of civil society. Participants noted that science undoubtedly used to see itself in this way, but no longer did. Civil society groups can help bring about a democratic science by creating space for dialogue with scientists and putting pressure on those in power for a democratic science agenda.

7 Conclusion: a democratic science agenda

After the underlying rationale and values of a democratic science initiative were formulated, participants developed a democratic science agenda. They identified the need for a *democratic science collective,* saying that it should have the following characteristics:

The role of a democratic science collective:

To encourage informal communications and develop dialogues/relationships between government, business, media, civil society, science and the many publics to:

- identify science and technology issues
- encourage openness, transparency, responsibility and accountability
- encourage the support of independent advice and research (including whistle-blowers)
- negotiate appropriate technological trajectories
- help develop skills and influence education policies
- promote equity in the distribution of knowledge and technological solutions
- forecast, recognise and resolve conflict and crisis
- monitor and influence policy by influencing agendas

Powers

A democratic science collective should have the power to obtain information, to give advice, and for this advice to be made public (through media and open meetings).

Features

Democratic science collectives should:

- have balanced interests
- be characterised by loose networks
- be independent
- be flexible, responsive, timely
- be permeable
- address global and local issues
- have local and full representation of producers, strategy makers and user communities (e.g. government, business, media, civil society, science and the many publics)
- take a Mode 2 organisation and a Mode 2 operational approach

Participants said that democratic science collectives should develop in a telescopic fashion, building upon organisations like the UK's Food Standards Agency. To ensure balanced interests, Government members should not

dominate. Membership should be 1/3 official to 2/3 not affiliated, perhaps through a mixture of appointment and election.

Starting point:

Participants were certain that democratic science collectives should be locally driven and self-built with the help of a small fixed core. To ensure trust, a democratic science collective should not be affiliated with official structures. It should not be a supranational organisation, and it should not have a centralised structure. It would have to guard against inflexibility, vested interests, arising conflicts, existing networks, financial dependencies, and would have to find a balance between permeability and stability.

Participants considered that a world without a democratic science, like the situation we have today, would be characterised by: a lack of knowledge, trust, and confidence; poor relationships between science and society, with people looking for scapegoats; panic reactions; and scientific and technological developments causing negative impacts on social well-being. Interestingly, participants said there is a 'Catch 22' situation, where a lack of openness causes system failure, and system failure leads to a lack of openness.

Action is urgently needed to kick-start a process to end this exclusion, to help groups of people to come together to work for a democratic science and more inclusive innovations. This action also needs to ensure that these groups have the power to obtain information, to give advice, and for this advice to be made public. As Kline writes, 'If this isn't the kind of society we want - one of included and excluded, and ever higher walls dividing the two - then the answer is . . . to reject the politics of division wholesale.' [25]

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